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IL-17A and CICs as Markers of Inflammatory Response in Hydatid Disease: Implications for Diagnosis and Post-surgical Monitoring

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ABSTRACT

Background: Hydatid disease continues to affect large populations as a major health problem, specifically within endemic areas due to Echinococcus granulosus infection. The disease activates immune complexes (CICs) together with different types of cytokines, while IL-17A functions as an essential component for inflammation. The investigation of IL-17A function together with CICs behavior in hydatid disease serves to develop better diagnostic methods and postoperative assessment tools.

Aim of the study: To investigate the assay value of IL-17A and CICs among hydatid disease patients before and after surgery to assess their usefulness for diagnosis and treatment assessment.

Materials and methods: Three groups of patients participated in the case-control study, divided into surgically treated patients with hydatid disease, patients who did not undergo surgery, and control groups. IL-17A and CICs measurements were performed by ELISA, while cyst confirmation was done by MRI.

Results: The measurement of IL-17A showed non-operated patients maintained much higher levels at 1,011.77 ± 317.78 Pg/ml than both operated patients, who had 411.37 ± 46.46 Pg/ml, and healthy controls, who maintained 161.51 ± 23.71 Pg/ml. The analysis revealed that non-operated patients presented with elevated CICs amounts (15.61 ± 3.32 µg/mL) compared to operated patients (7.73 ± 0.79 µg/mL) as well as controls (3.27 ± 1.00 µg/mL). The diagnostic evaluation through ROC analysis showed outstanding performance by measuring IL-17A and CICs with an equal 1.000 AUC for both markers.

Conclusion: IL-17A and CICs are considered diagnostic indicators for hydatid disease and postoperative patient monitoring. Active hydatid infections reveal high marker levels, which reduce after surgical intervention and support their clinical importance.

INTRODUCTION

The parasitic infection of cystic hydatid disease maintains cyclozoonotic characteristics since it has a worldwide distribution. The infection of livestock by Echinococcus tapeworm larva constitutes a vital parasitic condition that relies on various herbivores or rodents as intermediate hosts (Al-Jebory, 2012).

The development of improved diagnostic methods has focused mainly on exploring immune complex behavior alongside pro-inflammatory cytokine actions in CHD

investigations. Scientific research has focused on hydatid cyst antigens because they exhibit promising potential for testing in serology applications (Abu Jabel and Rogan, 2023).

IL-17A functions as an inflammatory cytokine receptor that scientists now use as a main indicator to study host inflammatory responses in CHD. IL-17A elevations in blood samples relate to specific pro-inflammatory responses which damage cyst-infected tissues while generating inflammation. This marker provides marker enables scientists to understand hydatid disease immunopathological processes while offering potential therapeutic targets (Maleki *et al.*, 2023).

Circulating immune complexes (CICs) materialize when the body produces antigen-antibody complexes as part of its hydatid cyst immune response. The parasite burden together with immune activation shows a direct relationship with CIC concentration therefore providing an opportunity to assess disease severity and progression level. The scientific community has found elevated CIC levels in active infections because these immune complexes likely contribute to tissue damage due to immune responses (Rouhani *et al.*, 2013).

The current diagnostic techniques for hydatid disease combine imaging procedures with serological tests but both methods show weak outcomes when differentiating active conditions from previous encounters with the parasite. IL-17A participates in inflammatory pathways which makes it a promising factor for measuring disease progression and surgical results. The validation of IL-17A as a diagnostic marker could transform hydatid disease management since it would boost both screening and patient follow-up efficiency. The purpose of this study examines both IL-17A levels together with CICs in patients with untreated and postoperative hydatid disease. The research should analyze IL-17A values versus CICs data to evaluate their capabilities as post-surgical disease surveillance tools as well as diagnostic indicators.

2. Methodology:

2.1. Study Design and Population

Case-control study included 90 participants of three groups: non-operated patients (31) diagnosed with hydatid disease through imaging and serological tests, operated patients (30) who had undergone surgical removal of hydatid cysts, and control group (29) of healthy individuals was also included for comparative analysis.

2.2. Sample Collection and Immunological Assays

Five ml of blood samples were collected from all participants in the current study to measure quantification of circulating immune complex (CICs) level using USA kit (Mybiosource) and IL-17A level using china kit (Cusabio) by ELISA.

2.3. Inclusion and Exclusion Criteria

Inclusion Criteria

In this study, several inclusion criteria were applied. Participants included patients diagnosed with hydatid cysts based on ultrasound findings.

Exclusion Criteria

Certain cases were excluded from this study based on specific criteria. Exclusion was applied to any case with incomplete information in the questionnaire. Additionally, individuals with cancer, autoimmune disease and chronic diseases were not included in the study.

2.4. Ethical Standards

The current study received official approval from the Medical Laboratory Services Division of the College of Health and Medical Technologies, the Najaf Health Department, and the Training and Development Center (Approval No. 37907). In addition, informed written consent was obtained from all participants in all study groups.

2.5. Statistical analysis

The study utilizes both descriptive statistics which present mean value along with standard deviation, standard error and minimum and maximum measures combined with

inferential statistics which show group differences. A p-value to check for significant statistical differences between groups keeping a 0.05 threshold for defining significance levels. Receiver operating curve (ROC) test also used to determine the diagnostic ability of makers.

3. Results and discussion

3.1. Immunological markers levels in studied groups

Table (1) presents a detailed of immunological markers between non-operated patients, operated patients and healthy controls. The data presents average findings and standard deviations of immune parameters to analyze age along with circulating immune complexes (CICs) and pro-inflammatory cytokine IL-17A. Studies show that the three groups demonstrate clear distinctions in these markers to demonstrate their active involvement in *Echinococcus granulosus* infection responses for hydatid disease.

Table (1): Immunological markers levels in studied groups

Studied groups		Mean	Std. Deviation	Std. Error	Minimum	Maximum	p-value
Age (year)	Non-Operated	37.90	12.09	2.17	20	70	0.717 ns
	Operated patients	38.90	13.05	2.38	20	70	
	Control	40.62	13.85	2.57	24	70	
CICs µg/mL	Non-Operated	15.61	3.32	0.60	10.50	23.00	0.0002*
	Operated patients	7.73	0.79	0.14	6.00	8.80	
	Control	3.27	1.00	0.19	1.50	5.00	
IL-17A Pg/ml	Non-Operated	1,011.77	317.78	57.07	447.00	1,507	0.0001*
	Operated patients	411.37	46.46	8.48	300.00	490	
	Control	161.51	23.71	4.40	133.34	215.28	

Significant differences at p- value < 0.05.

The results from non-operative patients reveal that their circulating immune complexes (CICs) (15.61±3.15 µg/mL) and IL-17A (1011.77±25.45 Pg/ml) measured at high levels. Evidence suggests that an aggressive immune response develops because of active hydatid cyst presence against Echinococcus granulosus .

The high investigation levels of CICs indicate ongoing antigen-antibody cross-linking in accordance with Sharma and Gupta (2021) who linked increased CICs to immune-mediated inflammatory processes.

High detection of IL-17A is particularly key because it signifies inflammatory activity necessary for neutrophils and total immune defense matching Zhang *et al.*'s (2021) findings on IL-17A-enhanced parasitic inflammation response. Research outcomes revealed operated patients showed decreased markers compared to the control group with results of CICs (7.73±1.11 µg/mL) and IL-17A (411.37±15.65 Pg/ml). Clinical removal of the antigen alters the operational load thereby significantly decreasing the triggering of immune activation. The results affirm the research of Chen *et al.* (2014) which showed decreased immunological marker levels after successful hydatid cyst surgery. Operated patients show decreased CIC levels which strengthens the understanding that surgical procedures effectively minimize immune complex formation from continuing parasitic illness. Research findings reveal that resolving infections through surgery results in a reduction of IL-17A levels thus leading to decreased inflammatory responses.

Control group CICs values (3.27±0.45 µg/mL) and IL-17A values (161.51±10.55 Pg/ml) attest to their un activated immune state which represents healthy subject baseline values. The operational differences between non-operated and operated patients become even more prominent through these research findings which prove the need for surgical interventions to recover immune function.

The low mark levels among control subjects support the theory that elevated immunological responses in non-operated hydatid disease patients stem from disease-related pathologic processes instead of natural individual immune response variation.

3.2. Receiver Operating Characteristic (ROC) Curve Analysis

The diagnostic capability of different markers in hydatid disease is assessed through ROC analysis.

The diagnostic performance of immunological markers CICs (µg/mL) and IL-17A (pg/ml) stands exceptional according to ROC curve analysis results (Table 2).

Table (2): ROC curve analysis

Area Under the ROC Curve								
Test Result Variable(s)	Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval		Cutoff	Sensitivity	Specificity
				Lower Bound	Upper Bound			
CICs µg/mL	1.000	0.000	0.0001	1.000	1.000	5.50	1.000	1.000
IL-17A Pg/ml	1.000	0.000	0.0001	1.000	1.000	257.64	1.000	1.000
a. Under the nonparametric assumption								
b. Null hypothesis: true area = 0.5								

ROC curve analysis validates the clinical reliability of both CICs and IL-17A through their perfect AUC results of 1.000 which coincides with assessment parameters of 1.000 sensitivity and specificity values. Shaker Mahmoud *et al.* (2024) identified IL-17 as contributing to hydatid disease immunopathogenesis while Ye *et al.* (2016) clarified that IL-17 and other cytokines affect severe anaphylaxis reactions in this context. The evidence establishes that doctors should consider adding IL-17A as a diagnostic marker for hydatid disease testing.

The performance characteristics of CICs together with IL-17A validate their importance for diagnosing and managing cases of hydatid disease.

4. Conclusions

Non-operated hydatid disease patients exhibited increased IL-17A combined with elevated CICs compared to operated patients and healthy controls thus validating their potential as valid tests for active hydatid disease infection. IL-17A and CICs levels demonstrate their potential diagnostic value because they decrease significantly after surgical procedures for disease tracking post-intervention. High levels of IL-17A show a direct connection to the inflammatory activity levels in patients thus establishing the protein's capacity to reveal disease seriousness in Echinococcus granulosus infections. The diagnostic potential of IL-17A and CICs received ROC curve confirmation, which demonstrated their suitability for diagnosis procedures in hydatid disease evaluation.

5. Funding

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6. Conflict of interest

There are no conflicts of interest regarding this research

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